Mean p_T in non-central high energy heavy ion collisions*

J. Yang†, M. Bleicher, X.H. Li, D. Olson, S. Panitkin‡, R. Snellings, J.B. Zhang, and N. Xu

A new form of matter is expected to be created in the heavy-ion collisions at RHIC. Flow analysis, anisotropic flow (directed and elliptic) and radial flow, is one of the most powerful tools to access the equation of the state (EOS) of the matter produced in the collisions. The radial flow is the driving force, and in the case of non-cetral collisions, the overlapped region is not symmetric azimuthally and the rescattering transfer the coordinate ansymmetry to the momentum space - leading to the observed anisotropy flow. For a given impact parameter, the degree of the transformation is related to the equation EOS physics.

In order to understand the observed p_t dependence of the HBT size parameters and the flow behavior in single particle spectra, and to disentangle geometrical and dynamical components of the observed event anisotropy, several authors have already addressed the necessity of studies of the non-central heavy ion collisions [1]. In this paper, we study the $\langle p_t \rangle$ of pions, Kaons, and protons as a function of azimuthal angle $Au + Au$ non-central collisions at $\sqrt{s} = 200$AGeV. The impact parameter range used is $b = 7 - 9$ fm. The RQMD(v2.4) event generator [2] was used to simulate the events.

Figure 1 shows the $\langle p_t \rangle$ as a function of rapidity for nucleons, kaons, and pions. In the figure, particles coming from in-plane and out-of-plane are shown as solid and dashed lines, respectively. Around mid-rapidity, the values of $\langle p_t \rangle$ are proportional to the particle mass. Furthermore, the difference in $\langle p_t \rangle$ is also proportional to the mass of particles, namely, the difference in $\langle p_t \rangle$ between pions and kaons is less than that for kaons and nucleons. Such dependence leads to the mass dependence of the slope parameters which was interpreted as the evidence of the hydrotype collective flow developed in heavy ion collisions. More interestingly, as one can see in the figure, for a given particle, there is a finer splitting in $\langle p_t \rangle$ with respect to its azimuthal angle. The in-plane values are always larger than that of the out-of-plane's. The fine splitting structure is proportional to the mass of the particle. If the system could be described by the hydrodynamics, this observation indicates a larger in-plane pressure gradient compared to that of out-of-plane, consistent with the pressure gradient study.

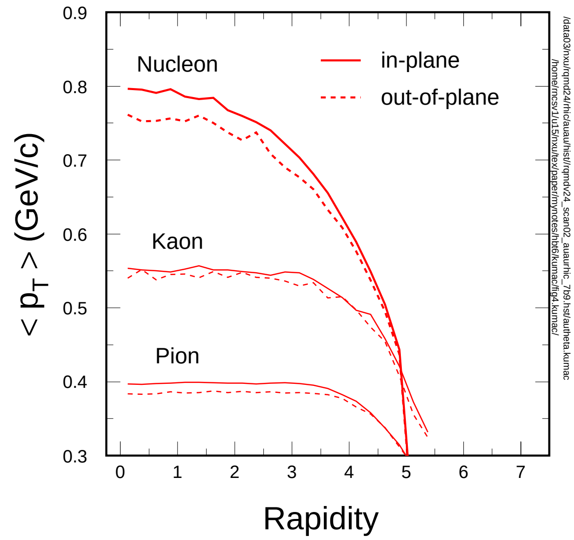

Figure 1: *RQMD predictions of $\langle p_t \rangle$ for nucleons, kaons, and pions from non-central Au+Au collisions at $\sqrt{s} = 200$ $AGeV$. The impact range is $b = 7 - 9$ fm. Solid lines and dashed lines represent values of $\langle p_t \rangle$ for particles emitted in-plane and out-of-plane, respectively.*

Footnotes and References

*submitted to Phys. Rev. Lett., January, 2000

†Department of Physics and Astronomy, UCLA

‡Department of Physics, Kent State University

[1] S. Voloshin and W. Cleland, Phys. Rev. **C53**, 896(1996); *ibid.* **54**, 3212(1996)

[2] H. Sorge, Phys. Rev. C **52**, 3291 (1995)